

CEO Effects on Firm Value and Its Components

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ABSTRACT

In this paper, we contribute to the ongoing debate about the extent to which CEOs influence firm performance. We also seek to shift the existing debate from its narrower focus on CEO effects on firm performance (typically measured as ROA) to a broader focus on CEO effects on firm value (operationalized in terms of Tobin's Q) and on the components of firm value. We analyze the three components of firm value: current performance (ROA), leverage (equity multiplier), and market valuation (price-to-earnings ratio). We also introduce a methodological innovation, the fixed effect least squares dummy variable (FELSDV) approach, to better understand the specific influence of CEOs on firms. The advantage of the FELSDV approach is that the CEO and firm effects are identified. Empirically, we find CEOs' impact on firm value and its components are large. We examine the correlation among the CEOs' unobservable time-invariant traits that impact firm value and its components. Our results have important implications for boards of directors in selecting and evaluating CEOs.

Keywords: CEO influences, executive leadership, firm performance, variance decomposition

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1. Introduction

One of the central issues in strategic management is the relative importance of the factors that determine firm value. Whereas much research has focused on the importance of external factors such as the industry environment within which the firm operates relative to firm specific factors (e.g., Schmalensee, 1985; Wernerfelt & Montgomery, 1988; McGahan, 1999; Rumelt, 1991), there has also been persistent interest in the influence on CEOs on firm performance (Crossland & Hambrick, 2007; Lieberman & O'Connor, 1972; Wasserman, Anand, & Nohria, 2001). Although earlier research suggests that CEOs' influence on firm performance is limited (e.g., Day & Lord, 1988; Hambrick & Mason, 1984; Thomas, 1988; Wiener, 1978), more recent research, using improved methodologies, suggests that CEOs have a substantial effect on firm performance (e.g., Carpenter, Geletkanycz, & Sanders, 2004; Hambrick & Quigley, 2014; Mackey 2008). Furthermore, the effect of CEOs on performance has become more important over time (Quigley & Hambrick, 2015). Nonetheless, the recent debate between Fitza (2014, 2017) and Quigley & Graffin (2017) suggests the issue of the extent to which CEOs influence firm performance is not entirely settled.

We contribute to this debate in several ways. First, we distinguish between firm performance and firm value. Firm performance is the result of the firm's activities over some period of time, typically measured in financial terms. Much of the existing literature has examined firm performance, typically measured by return on assets (ROA). Return on assets, however, is just one component of firm value. Firm value is the market value of the firm's assets measured at a point in time. Since the objective of management is, or at least should be, to maximize firm value, in this paper we focus on the effects of CEOs on firm value.

We measure firm value by Tobin's Q. Tobin's Q is widely used in the economics and finance literatures and has been used in the management literature by McGahan (1999), Wernerfelt & Montgomery (1988) and Wassermann, Nohira, & Anand (2001), among others. Performance measures such as ROA use historical data and are backward-looking. Q incorporates the market's expectation of future performance and is forward looking. Since it is based on market valuations, it implicitly uses the appropriate risk-adjusted rate to discount expected future equilibrium returns, minimizes distortions due to tax and accounting rules and captures the value of intangible assets (Wernerfelt & Montgomery, 1988). As Lang and Stulz (1994, p. 1249) point out "no risk adjustment or normalization is required to compare q across firms." We show that firm value can be decomposed into three components: a current performance component captured by return on assets (ROA), a capital structure or leverage component, captured by the equity multiplier (EM) or ratio of the market value of the firm's assets to its equity and a market valuation component, captured by the price/earnings ratio (PE) (Chi & Wu, 2012; Fang, Noe, & Tice, 2009).

We examine the CEO effect on firm value and its components. The CEO effect on each of the individual components is of interest in its own right. There is now a substantial body of literature that examines CEO effects on performance as measured by ROA. There is a smaller body of literature that examines CEO effects on firms' capital structure, much of it in the finance literature (e.g. Berger, Ofek, & Yermack, 1997; Cronqvist, Makhija, & Yonker, 2012; Lemmon, Roberts, & Zender, 2008; see Graham & Leary, 2011 for a review). Our review of the literature suggests that this is the first paper to examine CEO effects on the PE ratio, and the first paper to examine CEO effects on firm value and its components jointly. Knowing which components CEOs have the greatest impact on would be helpful to boards of directors in evaluating and

selecting potential candidates for a firm's CEO. For instance, if CEOs have the greatest potential impact on market expectations (i.e., captured in price/earnings ratio), then boards may need to adjust the weighted importance of a candidate's persona and ability to gain positive attention from external stakeholders (Treadway, Adams, Ranft, & Ferris, 2009) in CEO selection decisions.

As in the previous literature, we use Anova and Ancova to estimate CEO, firm and industry effects and variance decomposition to analyze the importance of the CEO, firm and industry effects. Our estimated CEO effects are at the upper end of those reported in the literature and explain more variation than firm and industry effects. As Mackey (2008) points out, if some CEOs do not move between firms in the sample, or if CEO movement is not tracked, then CEO effects are nested with the firm effects and CEO and firm effects are conflated. In a methodological contribution, we also use the fixed effect least squares dummy variable (FELSDV) approach, developed in Aboud, Kramerz, and Margolis (1999), to estimate CEO and firm effects. An important benefit of this approach is that the CEO and firm effects are identified. Identification means that we can uniquely recover the CEO and firm effects from the observable population that data are drawn from (Lewbel, 2017, p. 3). Use of the FELSDV approach means that we can estimate the amount of total variation attributed to the CEO, firm and time period while controlling for other factors and using a large data set. Using the FELSDV approach, our estimated CEO effects are large and explain more variation than firm and industry effects. Fitza (2014, 2017) argues that the CEO effects reported in the literature can be attributed to chance. To address Fitza's critique, we test for the statistical significance of the variance decompositions. All of the estimated CEO and firm variance components are statistically significant, so the probability that our results are due to chance is quite small.

The CEO fixed effects capture the CEO's unobservable time-invariant traits such as personality and psychological traits, life experience and human capital in the form of knowledge, skills, ability and other characteristics (KSAOs) that impact firm value or the component of firm value under examination. Whether the managerial traits that have an important impact on firm value and its components are closely related or not is an open question that has not been addressed in the literature. To examine this issue, we estimate the correlations among the CEO effects for firm value and for the components of firm value. A positive correlation suggests that CEOs who have the managerial traits that are important for firm value are likely to have the traits that are important for, say, managing capital structure. A negative correlation suggests the opposite. This has implications for the traits that a board of directors should look for in a CEO.

2. Components of Firm Value

Previous research acknowledges that high quality managerial skill is a scarce resource in organizations, an issue further complicated by the notion that a given CEO's skill set might be a good fit for one firm but a poor match for another firm (Hambrick & Quigley, 2014; Mackey, Malloy, & Morris, 2014). In particular, we suggest that top management skill is scarce because CEOs have the potential to influence multiple components of firm value, but doing so requires CEOs to possess multiple, sometimes competing competencies (Groysberg, Kelly, & MacDonald, 2011). We outline three firm outcomes that CEOs are likely to affect and describe the competencies associated with each outcome.

We distinguish between firm performance and firm value. Firm performance is the result of the firm's activities over some period of time, typically measured in financial terms. Firm value is the market value of the firm's assets measured at a point in time. Equivalently, firm

value is the sum of all claims by creditors and equity holders. We use Tobin's Q as our measure of firm value.

Tobin's Q is the ratio of the market value of the firm's assets (MVA) to their replacement cost. Replacement cost is approximated by the book value of assets (BVA), so that $Q = MVA/BVA$. We multiply and divide Q by the market value of equity (MVE) and multiply and divide by earnings before interest, depreciation and taxes (INC); this is simply an algebraic manipulation. This yields the following:

$$\begin{aligned} Q &= MVA/BVA = (MVA/BVA) \times (MVE/MVE) \times (INC/INC) \\ &= (INC/BVA) \times (MVA/MVE) \times (MVE/INC) \end{aligned}$$

The first term (INC/BVA) is return on assets (ROA), the second term (MVA/MVE) is the equity multiplier (EM), and the third term (MVE/INC) is the price-to-earnings ratio (PE). These are, respectively, the current performance component, the capital structure or leverage component and the market valuation component of firm value.

Return on assets (ROA) is calculated by dividing net income by a firm's year-end book assets. ROA is a measure of firm performance in a given time period and it captures the current CEO's ability to manage the firm efficiently. The calculation of ROA also reflects both past strategic decisions, e.g., past investments in assets, as well as current strategic decisions, e.g., current investments in R&D. CEOs may facilitate firm outcomes through general rather than firm-specific skills (Bertrand, 2009), such as organizing and motivating employees to work efficiently or to market products effectively. CEOs can increase firm value because their skill at directly controlling decisions that influence firm operations, such as costs and revenues, could affect current performance (Bertrand & Schoar, 2003). Thus, a CEO with strengths in maximizing current performance may influence firm value through superior ROA. The

hypothesis that CEOs influence firm value through superior ROA has received empirical support from prior research (Hambrick & Quigley, 2014; Mackey, 2008), but the significance of the results in the literature has been challenged by Fitza (2014, 2017).

Hypothesis 1: CEOs affect firm value through their effect on ROA.

The equity multiplier (EM) is the ratio of the market value of assets to the market value of equity and is equal to the ratio of debt to equity plus one. The firm's assets must be purchased and there are two sources of capital to acquire assets, debt and equity. Debt is capital contributed by lenders and must be repaid, whereas equity is capital contributed by owners either through the purchase of ownership or the retention of profits. The equity multiplier reflects the firm's strategic decisions about the extent to which it utilizes these two sources of capital and degree of financial risk it is willing to take. The optimal capital structure for a firm balances the costs of debt due to the conflict of interest between shareholders and bondholders and due to the risk of financial distress against the benefits of debt due to reduced conflicts of interest between shareholders and managers and due to the tax deductibility of interest payments. Too much debt is suboptimal and subjects firms to a high risk of unacceptable levels of financial distress or even bankruptcy (Andrade & Kaplan, 1998). Similarly, CEOs who take on too little debt may use their firm's financial resources in a suboptimal manner and may thereby fail to maximize the value of the firm for the shareholders (Graham, 2003; Miller, 1977).

Some recent research (Korteweg, 2010; van Binsbergen, Graham, & Yang, 2010) suggests that even fairly large deviations from the optimal capital structure have only a small effect on the value of the firm. If so, the market forces that move the firm toward its optimal capital structure are weak and the capital structure actually chosen may reflect the CEOs' personal preferences. There is evidence that CEOs' personal financing preferences affect

leverage decisions in the corporations they head (Bertrand & Schoar, 2003; Cronqvist, Makhija, & Yonker, 2012; Graham & Narasimhan, 2004; Malmandier, Tate, & Yan, 2011). It is well established that there is wide variation firms' capital structures. There is much more variation in capital structure between industries and between firms within industries than within firms (see, e.g., Lemmon, Roberts, & Zender 2008; MacKay & Phillips, 2005). This suggests that firm and industry effects are likely to be important determinants of EM.

Hypothesis 2: CEOs affect firm value through their effect on the equity multiplier.

The price-to-earnings (PE) ratio is the market's valuation of the firm's expected future performance. Prior work shows that the PE ratio is related to a firm's investment opportunities (Adam & Goyal, 2008). Investment opportunities depend on future discretionary investments (Myers, 1977), which ultimately depend on the CEO's ability to make strategic investments that take advantage of those opportunities. Thus, the PE ratio should be highly correlated with the strategic investments of the firm and ultimately with the CEO's skill in identifying strategic investments. Efficient market theory in finance states that all publicly available information is incorporated into stock prices. This implies that there may be a stock market reaction to the change in the CEO (Warner, Watts, & Wruck, 1988; Quigley, Crossland, & Campbell, 2017), but not to the CEO per se. Since the identity of the CEO is public information, then, particularly for experienced CEOs, there should be no effect on the stock price and on the PE ratio. On the other hand, consider a firm that grows at a constant rate g and pays a constant percentage of profits d as a dividend, and has a cost of equity (investors' required rate of return) r_e . Then the PE ratio is $PE = d/(r_e - g)$. That is, the PE ratio is determined by the cash returned to shareholders, the cost of equity, which in turn depends on the riskiness of the firm, and the firm's growth rate, which in

turn depends on the firm's strategic investments to take advantage of growth opportunities. All of these things can be affected by the CEO.

Visionary leaders demonstrate the cognitive capacity to identify strategic investments that can facilitate growth in the stock price of the firm (Helfat & Peteraf, 2015; Westley & Mintzberg, 1989). While CEOs may have less control over performance outcomes such as stock price, where macroeconomic fluctuations are outside a CEO's sphere of influence (Miller, Wiseman, & Gomez-Mejia, 2002), they do establish the strategic investment directions for the firm, such as through acquisitions and spinoffs, that will ultimately affect the firm's PE ratio (Sanders & Hambrick, 2007). However, as far as we know, there is no prior direct empirical evidence on the effect of the CEO on the PE ratio.

Hypothesis 3: CEOs affect firm value through their effect on the PE ratio.

Taken together, the terms in the decomposition of Tobin's Q capture the CEO's decisions about current operating strategy, financial strategy and investment strategy. We should point out that this decomposition is not unique. There are other ways that Tobin's Q could be decomposed to analyze the components of firm value. For example, ROA can be further decomposed to examine the efficiency of the firm's asset turnover and net profit. Our view is that alternative decompositions are unlikely to generate substantially different insights. An issue with ROA is that, in addition to measuring current performance, it "... reflects a firm's historical advantages." and "... reflects the competence of management at some point in the past." (McGahan, 1999, p. 377). In principle, we would like to be able to separate the impact of past management from the impact of the current CEO. However, no decomposition of ROA accomplishes this. Consequently, we do not pursue those possibilities here. We should also point out that the terms in the decomposition are not independent. From a purely mechanical view, increasing the current

period investments in R&D, advertising, or other strategic initiatives decreases ROA. If these are, in fact, good strategic investments, the decrease in ROA would be more than offset by increases in the firm's PE ratio.

3. Materials and Methods

3.1 Data and Sample

We use the Compustat Executive Compensation (ExecuComp) database, which reports data for the CEOs of many S&P large-, mid-, and small-cap companies, about 1,500 firms per year. We use data from 1992 through 2011, which is the same sample period examined in Hambrick and Quigley (2014). Our data set excludes financial firms (SIC codes 6000-6999) because their assets and liabilities are fundamentally different than those of industrial firms. We also exclude utility firms (SIC codes 4900-4999) because of their history of regulation. We combine the ExecuComp data on CEO identifier with data on firms' financial characteristics from Compustat and stock return data from the Center for Research in Security Prices (CRSP). We eliminate observations for which the firm's sales or assets are missing and for which the firm has zero earnings. The sample contains 961 CEOs and 628 firms. The resulting data set contains 5,816 observations over these 20 years.

Descriptive statistics for the sample are provided in Table 1 (see below). The dependent variables are ROA, EM and PE and Tobin's Q. The mean ROA is 0.12 (median 0.12). The mean equity multiplier is 10.58 (median 1.73). The larger mean value suggests that the distribution of EM is skewed; this may be due to later part of the sample including the financial crisis. We winsorize EM at the 1% level and the mean winsorized value is 3.19. The mean value of PE is -22.29 (median 6.46). The negative mean results from a larger number of firms with negative

earnings in 2005, 2008 and 2009, potentially due to the financial crisis. Specifically, 24 firms had negative PE ratios in 2005, 34 in 2008 and 30 in 2009.

Combined, nearly 28% (88/318) of firms had negative PE ratios for these three years. To remove potential outliers, we winsorize this ratio at the 1% level; the winsorized mean is 8.07. We use the winsorized values of PE and EM in all subsequent analysis. The mean value of Tobin's Q is 1.92 while the median is 1.42.

Table 1: Descriptive Statistics

Panel A: Dependent variables			
	Mean	Median	Std Dev
ROA	0.12	0.12	0.12
EM	10.58	1.73	271
EM (winsorized 1%)	3.19	1.73	5.40
PE	-22.29	6.46	2163
PE (winsorized 1%)	8.07	6.46	12.91
Q	1.92	1.42	2.60
Panel B: Control variables			
	Mean	Median	Std Dev
Sales (millions \$)	5584	1697	12130
Ownership (%)	5.53	0.00	42.47
PPE	0.82	0.40	1.21
RD	0.09	0.00	1.69
Advertising	0.01	0.00	0.04
Capital expenditures	0.05	0.04	0.06
Stock return volatility	0.41	0.35	0.24
Panel C: Number of observations			
Total observations (N)	5816		
Missing observations RD	3410		
Missing observations Advertising	3873		

Panel B reports descriptive statistics for control variables used in multivariate tests later in the paper. All dollar amounts are reported in constant 1992 dollars. We measure sales as the

fiscal year-end annual dollar value of sales. Execucomp consists of many large firms and mean sales is \$5.58 billion. The median (\$1.70 billion) is less than half as large, suggesting the sample distribution of sales is skewed. Consequently, in further analysis we use the natural log of sales. We measure ownership as the percentage of common shares outstanding that the CEO owns. With many larger firms, CEO ownership is a smaller percent of firm value. Mean ownership is 5.53% (median 0.00%). A body of literature indicates that CEOs with more ownership are more likely to act in shareholder interests (Jensen & Meckling, 1976) suggesting that more ownership is associated with higher Q firms. Other literature suggests ownership structure is not linear (Morck, Schiefner, & Vishney, 1988) and we use ownership squared in our analysis to control for this. While CEO stock ownership is likely a large part of a CEO's wealth, the median figure 0.00% implies that over half of all CEOs have no equity holdings in their firms.

Other control variables include property plant and equipment, research and development, advertising, capital expenditures and stock return volatility. We include each of these variables in the model because prior literature suggests that each variable could have an effect on firm value (Himmelberg, Hubbard, & Palia, 1999). Property plant and equipment (PPE) is measured as the value of the property plant and equipment for the firm divided by sales. PPE has a mean value of 0.82 (median 0.40). Research and development (R&D) is measured as research and development expense divided by sales; it has a mean value of 0.09 (median 0.00). Advertising is measured as advertising expense divided by sales; it has a mean value of 0.01 (median 0.00). Capital expenditures are measured as capital expenditures expense divided by total assets; it has a mean value of 0.05 (median 0.04). Many firms have missing and zero values for R&D (59% or 3,410 out of 5,816) and advertising (66% or 3,865 out of 5,816). For these two variables, we use indicator variables equal to 1 if R&D or advertising has a zero or missing observation. Stock

return volatility is measured as the annualized standard deviation of the firm's stock return over the 36 months prior to the end of the fiscal year. Mean volatility for the sample is 41% and median volatility is 35%.

3.2 Empirical Model and Estimation

The starting point for our analysis is the empirical Anova model of firm performance:

$$Y_{ijt} = \alpha + \theta_i + \varphi_j + \mu_t + \varepsilon_{ijt},$$

where Y_{ijt} is the measure of performance for firm j with CEO i in period t , α is the intercept, θ_i is the time-invariant CEO effect, φ_j is the time-invariant firm effect, μ_t is the period effect, and ε_{ijt} is the error term. Given the well-known limitations of sequential Anova (McGahan & Porter, 2002), we use simultaneous Anova.

We then add covariates to the model and the empirical model takes the form:

$$Y_{ijt} = \alpha + x_{it}\beta + z_{jt}\gamma + \theta_i + \varphi_j + \mu_t + \varepsilon_{ijt},$$

where Y_{ijt} is the measure of performance for firm j with CEO i in period t , α is the intercept, x_{it} is the vector of CEO time varying characteristics that includes ownership and ownership squared, z_{jt} is the vector of observable time-varying firm characteristics, θ_i is the time-invariant CEO effect, φ_j is the time-invariant firm effect, μ_t is the period effect, and ε_{ijt} is the error term.

We estimate the variance decomposition to analyze the importance of CEOs effects, firm effects and the effects of control variables. The model R^2 is

$$\text{Cov}(y, \hat{y})/\text{var}(y) = \text{cov}(y, \sum_{k=1}^K \hat{\beta}_k z_k) / \text{var}(y) = \sum_{k=1}^K \text{cov}(y, \hat{\beta}_k z_k) / \text{var}(y) = \sum_{k=1}^K R_k^2,$$

where the z_k are the right-hand side variables (including the fixed effects) and R_k^2 is the partial R^2 for the k^{th} variable. Fitza (2014, 2017) points out that if the variance component is small, then the effect is not statistically significant. From the algebra of least squares, if there are N observations

and K parameters, the F -statistic is $F = [R^2/K]/[(1 - R^2)/(N - K)]$, or equivalently, $R^2 = F/[F - 1 + N/K]$. Thus, for example, if $N = 100$ and $K = 10$, the 5% critical value of F is 1.94 and the corresponding critical value of R^2 is 17.66%. We carry out the relevant F -tests and report the statistical significance of our all of our Anova and Ancova results and all of our variance decompositions.

4. Results

4.1 Anova and Ancova Results

We analyze the effects of CEOs on all three components -- current performance (ROA), capital structure or leverage (EM) and market valuation (PE) -- and on firm value as measured by Tobin's Q in Table 2. We present Anova results in Panel A and Ancova model results, with control variables, in Panel B. In Panel A, CEO effects have greater influence on all three components of firm value than either firm effects or year-specific effects. The estimated CEO effect is 0.32 for ROA, 0.44 for EM and 0.27 for PE. The CEO effects are all statistically significant at the 1% level. Firm effects are 0.08 for ROA, 0.17 for EM and 0.08 for PE; all firm effects are statistically significant. This result suggests that CEOs play a major role in determining firm value and that CEOs affect all three components, current performance, capital structure and market valuation, to increase firm value. The results are similar for Tobin's Q . The CEO effect is 0.32 while the firm effect is 0.05; both effects are statistically significant.

In Panel B, CEO effects again have a great influence on all three components of firm value. Once control variables are added, the CEO effect for ROA drops to 0.29, while it marginally increases for EM and PE. The CEO effect for Q increases from 0.32 to 0.42, while the firm effect falls to 0.04; both effects are statistically significant. Overall, the results in Table 2

imply that CEOs have a major impact on firm value and on the three components of firm value. The empirical results strongly support all three hypotheses.

These results are qualitatively similar to the effects of CEOs on firm performance found by Mackey (2008) and Hambrick and Quigley (2014). Our results are also similar to Coles and Li (2013), who find that top management team effects account for about 40 percent of the variation in Q. Taken together, these results suggest that the variance in ROA, EM, PE and Q are better explained through CEO effects than through firm and control variable effects.

We include industry effects in the Anova and Ancova models in Table 3 to compare our results to the prior literature once we control for industry. The Anova results in Panel A suggest that CEO effects are most important in explaining ROA (22%) followed by firm (5%), industry (4%) and year (1%). The results for ROA are in line with Mackey (2008) where the variance components are CEO (29%), firm (8%), industry (6%) and year (1%). The similarity to Mackey (2008) is not surprising since our sample period (1992-2011) is similar to the period (1992-2002) used in Mackey (2008).

The Ancova results, in Panel B, show that the CEO effects are most important in explaining ROA (18%), followed by industry (5%), firm (4%) and year (1%). While the percentages for industry and firm reverse in the Ancova model, the difference between the two variables is small, just once percent, suggesting that they are not meaningfully different from one another. All of the results in Table 3 are statistically significant. Nonetheless, the Ancova results are based on a reduced sample size compared to the Anova results, because of the covariates, and therefore, a comparison of the Panel A results to the Panel B results should be interpreted with caution.

Table 2: How CEOs Influence Firm Value: Anova and Ancova models

Panel A: Anova				
	ROA	EM	PE	Q
CEO effects	0.32***	0.45***	0.27***	0.32***
Firm effects	0.08***	0.17***	0.08***	0.05***
Year	0.01***	0.01***	0.01***	0.02***
Residual	0.27	0.25	0.55	0.49
Adj R ²	0.65	0.68	0.29	0.37
N	5,816	5,816	5,816	5,816
Panel B: Ancova				
	ROA	EM	PE	Q
CEO effects	0.29***	0.48***	0.29***	0.42***
Firm effects	0.08***	0.13***	0.06***	0.04***
Year	0.01***	0.01***	0.01***	0.01***
Residual	0.25	0.19	0.54	0.36
Adj R ²	0.67	0.75	0.29	0.52
N	5,159	5,159	5,159	5,159

* Note: ROA is measured as earnings before interest, taxes and depreciation (EBITDA) divided by book assets. PE is the market value of equity divided by EBITDA. EM is the market value of assets divided by the market value of equity. Q is measured as the market value of the firm's assets to its book value. Q can be written as $Q = ROA * PE * EM$. Panel A shows results using an Anova without covariates, Panel B shows results using Ancova.

The covariates include: Ownership is the total number of shares the executive owns divided by the common shares outstanding for the firm; it is a percent value. Ownership squared. Log(sales) is the natural log of the annual dollar value of sales. PPE is the value of property plant and equipment scaled by the value of the firm's sales. Research and development is research and development expense divided by sales. Advertising is measured as advertising expense divided by sales. Capital expenditures is measured as capital expenditures expense divided by total book assets. Stock return volatility is the annualized standard deviation of the firm's stock return for the 36 months prior to the fiscal year end. The symbols *, ** and *** indicate significance at the .1, .01, and .001 levels, respectively.

Compared to the results in Table 2, all of the effects in Table 3, except year, are smaller once we add industry to the analysis. The CEO effect is noticeably smaller for ROA and EM, both with and without controls, while the CEO effect for PE and Q is slightly smaller. The firm effects are slightly smaller for all of the models once we include industry effects and the year effects are unchanged. The overall fit of the models in Tables 2 and 3 are similar, suggesting that the industry effect is capturing the variance component attributed to the other effects when a control variable for industry is not included.

4.2 Fixed Effect Least Square Dummy Variable Results

Recent literature suggests that traditional regression models such as Anova may not be correctly specified. For instance, Mackey (2008) points out that there is a problem caused by nested CEO and firm effects. To overcome this problem she employs a sample of firms where at least one CEO has worked for more than one sample firm. A more recent methodology has been suggested by Abowd, Kramarz, & Margolis (1999). They use an approach known as the fixed effect least squares dummy variable (FELSDV) approach. This approach first differences the CEO fixed effects, then uses the least squares dummy variable approach to estimate firm and time effects. The individual CEO fixed effects are then recovered. This approach also utilizes group connection, the fact that some CEOs move from firm to firm, to overcome the identification problem. Group connection allows the identification of individual CEO and firm effects in a large data set (see Coles and Li, 2013; Graham, Li & Qi, 2012; and Brookman & Thistle, 2013). We illustrate group connection and identification of the CEO and firm effects in the Appendix. Our main objective in using FELSDV is to estimate the variance decomposition to analyze the size of the CEOs effects. That is, we want to estimate the amount of the total model

Table 3: Including Industry Effects: Anova and Ancova models

Panel A: Anova				
	ROA	EM	PE	Q
CEO effects	0.22***	0.33***	0.25***	0.30***
Firm effects	0.05***	0.12***	0.05***	0.03***
Industry	0.04***	0.08***	0.04***	0.02***
Year	0.01***	0.01***	0.01***	0.02***
Residual	0.27	0.25	0.55	0.49
Adj R ²	0.65	0.67	0.29	0.36
N	5,816	5,816	5,816	5,816
Panel B: Ancova				
	ROA	EM	PE	Q
CEO effects	0.18***	0.30***	0.25***	0.35***
Firm effects	0.04***	0.09***	0.03***	0.02***
Industry	0.05***	0.08***	0.03***	0.03***
Year	0.01***	0.01***	0.01***	0.01***
Residual	0.25	0.19	0.54	0.36
Adj R ²	0.67	0.75	0.29	0.52
N	5,159	5,159	5,159	5,159

* Note: ROA is measured as earnings before interest, taxes and depreciation (EBITDA) divided by book assets. PE is the market value of equity divided by EBITDA. EM is the market value of assets divided by the market value of equity. Q is measured as the market value of the firm's assets to its book value. Q can be written as $Q = ROA * PE * EM$. Panel A shows results using an Anova without covariates, Panel B shows results using Ancova.

The covariates include: Ownership is the total number of shares the executive owns divided by the common shares outstanding for the firm; it is a percent value. Ownership squared. Log(sales) is the natural log of the annual dollar value of sales. PPE is the value of property plant and equipment scaled by the value of the firm's sales. Research and development is research and development expense divided by sales. Advertising is measured as advertising expense divided by sales. Capital expenditures is measured as capital expenditures expense divided by total book assets. Stock return volatility is the annualized standard deviation of the firm's stock return for the 36 months prior to the fiscal year end. The symbols *, ** and *** indicate significance at the .1, .01, and .001 levels, respectively.

variance that is explained by the CEO while controlling for firm effect and the effects of control variables.

FELSDV does have a limitation that should be mentioned. We do not include industry effects in our analysis. These effects are incorporated in the firm effects in our model and are not identified. Abowd and Kramerz (1999) show that industry effects are a weighted average of firm effects and their omission does not bias the results. Given our focus on CEO effects and our research questions, this is a limitation we accept in order to identify the CEO effects. If our research questions focused on evaluating industry effects, a different approach would be preferable.

CEO mobility is an important part of the FELSDV approach and is used to identify the CEO and firm effects. Table 4 describes the mobility of the CEOs in our sample for 1992 to 2011. Panel A shows the number of firms in which CEOs in our sample have been employed. From 1992-2011, roughly 64% (617 of 961) of the CEOs have been employed by one firm in the sample, whereas over one-third had been employed by two or more firms. Panel B shows the number of CEOs who are “movers” (i.e., have moved among firms in our sample). Slightly over three-fourths of firms have between one and five mover CEOs over the sample period, 18% have between six and ten movers and 5.6% have between eleven and twenty movers.

Table 4: Chief Executive Officer Mobility

Panel A: Number of firms in which CEOs have been employed

Number of firms	Number of CEOs	Percent
1	617	64.20
2	325	33.92
3	17	1.77
4	2	0.21

Panel B: Number of movers in a firm

Number of CEOs	Number	Percent
1-5	480	76.43
6-10	113	17.99
11-20	35	5.57

Panel A of Table 5 incorporates the FELSDV method using group connection. It does not include covariates. The estimates of CEO effects are greater across the components than they are for the Anova models, suggesting that CEO effects explain a greater part of firm value than estimated in the Anova models. Specifically, CEO effects increase from 0.32 with the Anova model to 0.65 for ROA, from 0.44 to 0.46 for the EM and from 0.27 to 0.33 for PE. Again, all three CEO effects are statistically significant at the 1% level. The change in the effect is the largest for ROA. The models using the FELSDV method also account for a greater proportion of the variance for all three components of firm performance: 73% for the current earnings component, measured by ROA, 75% for the leverage component, measured by EM, and 45% for the market valuation component, measured by PE. The CEO effect on Tobin's Q increases from 0.32 to 0.44 in the FELSDV model. Similarly, the adjusted R^2 increases to 0.51 for Tobin's Q.

Panel B of Table 5 shows results for the FELSDV method using the full set of control variables. The control variables have been suppressed for ease of reading. The variance decompositions for ROA, EM and PE show that CEO effects account for 53% of the variation in firm value through the current earnings component, 41% through the leverage component, and 37% through the market valuation component. The CEO effects are statistically significant at the 1% level in all three variance decompositions. Firm effects are closer in size to CEO effects for the leverage component, but are much smaller than the CEO effects for the other two components. This result is consistent with prior work showing that firm effects are an important determinant of leverage (e.g., Coles & Li, 2013). The variance decompositions for firm effects and the control variables are all significant. The model suggests that CEOs appear especially likely to increase firm value through the current operating performance component. The results using the FELSDV method are also qualitatively similar to the Anova results and again strongly support all three Hypotheses. Assuming that the FELSDV results are caused by improved CEO fixed effects identification, we can conclude that the results suggest that the CEOs have a large effect on current operating performance and while the effect on the leverage and market valuation components is smaller than the effect on current performance, it is still substantial.

The FELSDV analysis in Table 5 is directly comparable to the Anova/Ancova analysis in Table 2. For ROA, the CEO effects are much larger while the firm and year effects are approximately the same. For the EM, the CEO effect is approximately the same without control variables and slightly smaller when controls are included. The firm effects are larger in the FELSDV model. For both PE and Q, the CEO effects are larger and the firm and year effects are approximately equal. The difference between the Anova/Ancova analysis and the FELSDV analysis is that the CEO and firm effects are identified in the FELSDV analysis.

Table 5: How CEOs Influence Firm Value: FELSDV method with group connection

Panel A: FELSDV without control variables

	ROA	EM	PE	Q
CEO effects	0.65***	0.46***	0.33***	0.44***
Firm effects	0.06***	0.27***	0.10***	0.05***
Year	0.02***	0.02***	0.02***	0.02***
Residual	0.27	0.25	0.55	0.49
Adj R ²	0.73	0.75	0.45	0.51
N	5,816	5,816	5,816	5,816

Panel B: FELSDV with control variables

	ROA	EM	PE	Q
CEO effects	0.53***	0.41***	0.37***	0.55***
Firm effects	0.07***	0.34***	0.08***	0.07***
Year	0.03***	0.01***	0.02***	0.02***
Residual	0.25	0.19	0.54	0.36
Adj R ²	0.75	0.81	0.46	0.64
N	5,159	5,159	5,159	5,159

**Note: ROA is measured as earnings before interest, taxes and depreciation (EBITDA) divided by book assets. PEPE is the market value of equity divided by EBITDA. EM is the market value of assets divided by the market value of equity. Q is measured as the market value of the firm's assets to its book value. Q can be written as $Q = ROA * PE * EM$.*

*Ownership is the total number of shares the executive owns divided by the common shares outstanding for the firm; it is a percent value. Ownership squared. Log(sales) is the natural log of the annual dollar value of sales. PPE is the value of property plant and equipment scaled by the value of the firm's sales. Research and development is research and development expense divided by sales. Advertising is measured as advertising expense divided by sales. Capital expenditures is measured as capital expenditures expense divided by total book assets. Stock return volatility is the annualized standard deviation of the firm's stock return for the 36 months prior to the fiscal year end. The symbols *, ** and *** indicate significance at the .1, .01, and .001 levels, respectively.*

While Table 5 shows that CEO effects are large for each of the models, we next question whether the CEO's effects are correlated across each of the models. The CEO fixed effects capture the CEO's unobservable time-invariant traits that impact firm value or the component of firm value under examination. These traits include personality and psychological traits, life experiences and human capital. Personality and psychological traits include charisma (Tosi, Misan-gyi, Fanellei, Waldman, & Yammarino, 2004), hope, optimism and resiliency (Peterson, Walumba, Byron, & Myrowitz, 2009), narcissism (Chatterjee & Hambrick, 2007) and overconfidence (e.g., Malmandier, Tate & Yan, 2011). Life experiences include entering the labor market during a recession (Schoar, & Zuo, 2017), military experience (Benmelechen & Frydman, 2015) and having a private pilot license (Cain & McKeon, 2016). Human capital include knowledge, skills ability and other characteristics (KSAOs), including general ability and execution ability (Kaplan, Klebanov, & Sorenson, 2012). While the CEO fixed effect reduces the vector of CEO traits to one dimension, this does not preclude different CEOs having different traits, or combinations of traits, that impact firm value and its components.

Highly correlated CEO effects would suggest that the CEO's unobservable traits are similar in each of the models. That is, what the CEO does, or who the CEO is, has a similar effect on firm value and the ROA, EM and PE components of firm value. Effects that are not highly correlated suggest that the unobserved traits of the CEOs differ between each of the components. We normalize the estimated CEO fixed effects so that they sum to zero within each group by subtracting the average group CEO effect. The result is CEO effects that are measured as deviations from the group means. This normalization makes correlations over all of the groups more appropriate (Cornelissen, 2008). We report the normalized correlations in Table 6.

Table 6: Correlation of CEO effects between the models

	ROA	EM	PE	Q
ROA	1			
EM	-0.15***	1		
PE	0.22***	-0.12***	1	
Q	0.32***	-0.06***	0.34***	1

*The symbols *, ** and *** indicate significance at the .1, .01, and .001 levels, respectively.*

The results show that CEO fixed effects for Q are positively correlated with the CEO fixed effects for ROA and PE. Similarly, the CEO fixed effects for ROA and PE are positively correlated. The correlations are statistically significant but relatively modest in magnitude. This suggests that, while there may be some similarity in the unobservable traits captured by the fixed effects, the traits are not the same. The correlations between the CEO fixed effects for EM and Q, ROA and PE are statistically significant, quite modest in magnitude and negative. This suggests that the unobservable traits that impact EM are different from the unobservable traits that impact firm value and the other components of firm value. These results support findings by van Binsbergen, Graham, and Yang (2010) who find that CFOs play a more significant part in capital structure decisions than in other firm policies and that debt policy tends to change when new CFOs, not CEOs, are added to a firm's management team. We conclude that the unobservable attributes that CEOs bring to the firm are similar for ROA, PE and Q, but are different for firm financing policy. From the perspective of a Board of Directors, the most important characteristics of a CEO are those that impact firm value. Our results suggest that there is some similarity in the characteristics that affect the ROA and PE components of firm value but no similarity with the characteristics that affect the EM component.

5. Discussion

While there is a long-standing interest in the influence of CEOs on firm performance, recent research (Fitza, 2014, 2017; Quigley & Graffin, 2017) suggests that this issue is not completely settled. We contribute to this ongoing debate in several ways. First, and in contrast to much of the existing literature, we focus on firm value. We argue that, since the objective of management is to maximize firm value, it is the more fundamental concept. Second, we show that firm value, as measured by Tobin's Q, can be decomposed into a current performance component (ROA), a capital structure or leverage component (the equity multiplier, EM) and a market valuation component (the PE ratio). We provide new estimates of the effect of CEOs on firm value and its components.

As in previous studies, we use Anova and Ancova to estimate the CEO effects. Our Anova and Ancova estimates of the variance components imply that CEO effects are substantial and larger than firm and industry effects for firm value and for all three components of firm value. We also employ the fixed effect least squares dummy variable (FELSDV) methodology. An important advantage of the FELSDV approach is that the CEO and firm effects are identified. That is, we can uniquely recover the CEO and firm effects from the population that the data are drawn from. Using variance decomposition, we find that CEOs account for over half of the variation in Tobin's Q, over half of the variation in ROA, and over one-third of the variation in EM and PE; the variance components are 55, 53, 41, and 37 percent, respectively. Firm effects are relatively small, except for the leverage component. Our results indicate that identification matters; our FELSDV estimates of the variance components are substantially larger than our Anova and Ancova estimates. Responding to Fitza's (2014, 2017) critique, we find that all of the

results are statistically significant. Overall, our results indicate that the impact of CEOs on firm value and on the components of firm value is large.

Hiring and evaluating CEOs are among the most important duties of boards of directors (Daily, Dalton, & Cannella, 2003). Our findings highlight that even as CEOs contribute to firm value, there are tradeoffs that boards of directors should consider. For instance, our finding that CEOs contribute more to current operations than to market valuation may offer an additional explanation for why hiring “celebrity CEOs” who allocate a relatively greater proportion of their attention to external stakeholders may sometimes hinder firm performance (Hayward, Rindova, & Pollock, 2004).

We now know that a variety of CEO characteristics, from expertise and functional background (Buyl, Boone, Hendriks, & Matthyssens, 2011) to individual differences such as narcissism and organizational identification (Peterson, Gavin, & Lange, 2012) affect firm performance. In our analysis, the CEO fixed effects capture the unobservable time-invariant CEO traits that impact firm value and its components. We examine the correlations among the CEO fixed effects for Q and the components of Q. Our objective is to gain some insight into whether the CEO traits that affect firm value are the same as the traits that affect the components of firm value. We find that the CEO fixed effects for Q, ROA and PE are positively correlated; the correlations are statistically significant but modest in size. The CEO fixed effects for EM are negatively correlated with those for Q, ROA and PE; the correlations are again significant, but small. This suggests that finding a CEO who has all of the traits that impact firm value and its components is likely to be a difficult task. Thus, boards of director would be well served to not only seek out CEO candidates who are a good fit with the needs of their firm (i.e., strategy, competitive environment) but also to surround the CEO with other top management team

members who have complementary skills that can impact the full range of the components of firm value.

Finally, we acknowledge an important limitation of our findings, which is that our data do not enable us to unpack the precise underlying mechanisms (i.e., open the “black box”) of how CEOs influence firm value. Future research is necessary to explore how CEOs impact firm value. Additionally, since CEOs operate in coordination with their Chief Financial Officer and other colleagues in the upper decision-making echelons of the firm, future research is also needed to explore the relative contributions of members of the entire top management team.

Appendix: FELSDV, Group Connection and the Identification of CEO Effects

In the Appendix we provide an example of how group connection can be used to identify the CEO and firm effects. The example follows our previous work (Brookman & Thistle, 2013). The FELSDV methodology is developed in Abowd, Creecy, and Kramarzs (2002); Abowd & Kramerz (1999); Abowd, Kramerz & Margolis (1999); Abowd, Haltiwanger, Jarmin, Lane, Lengermann, McCue, McKinney, & Sandusky (2005) and Cornelissen (2008).

Group connection is illustrated in Figure A1, which shows five firms and six CEOs divided into 2 groups. First, observe that three of the CEOs, A, C and E, change jobs in this example, so that a “mover sample” would only include these CEOs. CEO A initially works at firm 1, so both CEO A and firm 1 are in group 1. CEO A then changes jobs and becomes the CEO at firm 2, taking over from CEO B. Then CEO B and firm 2 is also included in group 1. CEO C works at firm 3 and firm 4 so CEO C and firms 3 and 4 are in group 2. Manager D has been the CEO at firm 3, so CEO D is also included in group 2. CEO E has worked at firms 4 and 5, so CEO E and firm 5 are added to group 2. CEO F has also worked at firm 5, so CEO F is also

in group 2. Note that CEOs D and F are connected, even though they have never worked at the same firm and have never changed jobs. Observe that there is no overlap between groups 1 and 2.

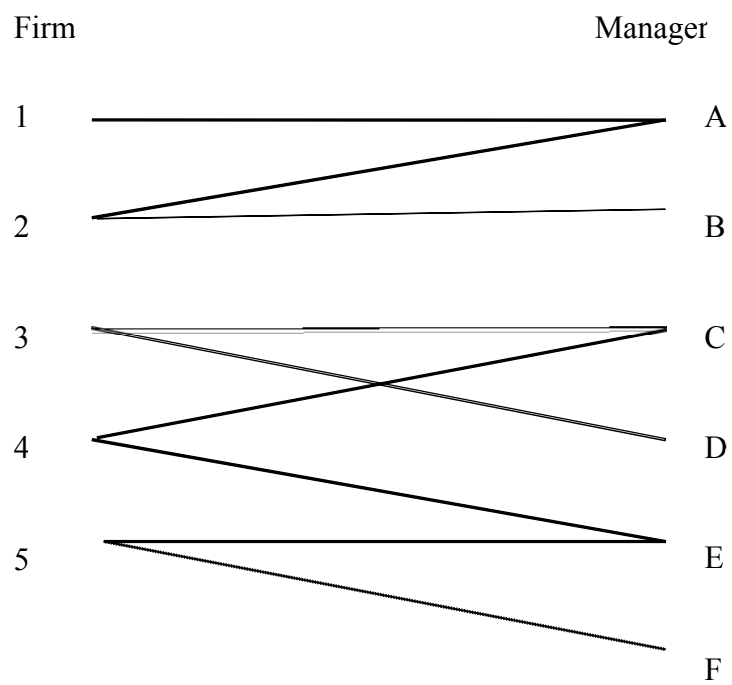
Within each group, all CEO and firm effects are identified up to a normalization. One of the CEO or firm effects must be taken as the benchmark and the remaining effects are measured as differences from the benchmark. If there are N_g CEOs and J_g firms in group g , then $N_g + J_g - 1$ effects are identified. If there are N CEOs, J firms and G groups in the data, then a total of $N + J - G$ CEO and firm effects are identified.

To see how mobility and group connection permits the identification of individual CEO and firm effects, consider the example in Figure A1. CEOs A and B are identical in all observable characteristics. Likewise, firms 1 and 2 are identical in all observable characteristics. Suppose while A is the CEO of firm 1, the value of the firm is \$1 billion. Now A moves to firm 2 as CEO, and the value of firm 2 is \$2 billion. While B is the CEO of firm 2, the value of the firm is \$3 billion. Since all else is equal, including CEO A's latent characteristics, this implies that firm 2 has a \$1 billion higher fixed effect than firm 1 ($\phi_2 - \phi_1 = 1.0$). Take firm 1's fixed effect as the benchmark and set it equal to zero ($\phi_1 = 0$). The CEO fixed effects are found by subtracting the firm fixed effects. Thus, CEO A's fixed effect is \$1 billion ($\theta_A = 1 - 0$ from firm 1 or $\theta_A = 2 - 1$ from firm 2). CEO B's fixed effect is \$2 billion ($\theta_B = 3 - 1$). Observe that we have two different estimates of A's effect, but, because θ_A is identified, the estimates must be the same. Also observe that since B only works at firm 2, B's effect is nested with firm 2. Nonetheless, B's effect is identified. We can proceed similarly to identify the CEO and firm effects in group 2. CEO C had moved from firm 3 (value \$4 billion) to firm 4 (value \$6 billion) so $\phi_4 - \phi_3 = 2$. CEO E also moved from firm 4 (value \$7 billion) to firm 5 (value \$8 billion) so $\phi_5 - \phi_4 = 1$. Take firm

3's effect as the benchmarks and set it equal to zero ($\phi_3 = 0$). Then the firm effects are $\phi_4 = 2$ and $\phi_5 = 3$. The CEO effects are $\theta_C = 4$ ($= 4 - 0$ from firm 3 or $6 - 2$ from firm 4), $\theta_D = 5$, $\theta_E = 5$ ($= 7 - 2$ from firm 4 or $= 8 - 3$ from firm 5) and $\theta_F = 6$. Again, the two estimates of the CEO effects for CEOs C and E are the same. Again, the effects for CEOs D and F are nested but identified.

FIGURE A1
Group Connection

Firm	CEO	Group	Value
1	A	1	1
2	A	1	2
2	B	1	3
3	C	2	4
3	D	2	5
4	C	2	6
4	E	2	7
5	E	2	8
5	F	2	9



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